Enerdrive

Lithium Power Pack

Lithium-Ion Battery System
Owner's Manual

V1.0 1/2015

Enerdrive Lithium Power Pack

Lithium-Ion Battery System

After 2 years of research, testing and proving, and a further 2 years of infield sales, Enerdrive has designed and created a COMPLETE Lithium Battery & Installation System so your Li-Ion battery bank is fully protected. Most importantly, our system is designed to give the maximum performance, longevity and SAFTEY in your valuable installations.

Be aware that the market is abuzz with the hot topic of Lithium Ion Batteries; and we can tell you from our testing to date that all the hype of their performance and capabilities is TRUE. However what we can also inform you is that all the stories of their 'Issues' are unfortunately also true. However the so called "issues' of lithium can be avoided with some very basic rules about protection.

- Never go over voltage whilst charging them
- Never let them go 'Dead' Flat
- Keep the individual cells 'Balanced'

What this lesson taught us was that to do Lithium – IT HAD TO BE DONE RIGHT!!
So we developed our own Lithium Power Pack for the Australian market with the emphasis on 'built like a tank'; and even to the extent of being a little bit 'overkill' on the packaging and protection.

So how does our system actually work?

The Advance BMS relay driver is designed to take a loop signal wire from the ePRO battery meter for low state of charge (SOC%)/Voltage & Hi system voltage and a loop signal wire from the batteries Cell balancers Hi/Low Volt cut-out circuit.

System Program Selection Switch;

The Advanced BMS Relay Driver has 2 pre- programed settings.

Output 1-4 Enabled - is programmed to utilise the output contacts. Using this program allows you to have the charging sources run through external relays allowing the BMS to isolate the charging source in the event of a cell voltage being too high without turning the whole electrical system off. In the event of low SOC% the main battery relay will be disengaged to protect the battery.

- **We strongly recommend this option for all installations.**

Output 1-4 Disabled - is programmed to bypass the output contacts. If the battery SOC% is low or cell voltage is high, the main battery relay will be disengaged, turning off the whole electrical system to protect the battery.

- **Subject to specific requirements, this option may only be suitable for certain applications. If unsure, please contact Enerdrive for further details.**

So how does the “Advance Enabled Setting” operate?

If a battery cell goes “Hi Voltage” and “opens” the hi voltage loop wire, then the Advanced BMS Relay Driver will activate the output contacts that will drive the installed relay/contacts to cut out all charging sources (solar/vehicle/main charger) for 10 minutes. If the cell has not come back within range before 10 minutes, it will stay active for another 10 minutes and repeat until the cell/s are within range. This setup allows the system loads to still be powered.

If the ePRO Battery monitor sees a LOW SOC% or overall low voltage, then the main battery relay will trip out. You will need to start a charging source and re-engage the main battery relay by pressing in the Yellow button on top of the main battery relay. The Advanced BMS Relay Driver will turn the main battery relay OFF every 6min if the SOC% on the battery monitor is still below the set point. So this may need to be reset a few times before the SOC% set point reaches it re-engagement point.

Main Battery Relay

PLEASE NOTE

The battery has a self-discharge rate of 5% per month @ 25°C. When storing the battery with the main latching relay disengaged, the ePRO Battery Monitor and Advance Relay Driver will still be powered, adding a further drain on the battery.

It is the responsibility of the end user to maintain the battery in a charged state. The battery should not be left for more than 30 days without checking its charge state. Enerdrive recommend that a battery left in a “storage state” should be checked and charged as often as possible (maximum 30 days) to maintain maximum life expectancy of the battery. Failure to follow these requirements will see an early failure of the battery which is not covered under warranty.

What's in the Enerdrive Lithium System?

To use the Enerdrive Lithium Power Pack you need to use two items together. These are:

- The actual lithium power pack battery box.
- The Advance BMS controller board which includes
- The Advance BMS Relay Driver box
- The ePRO Battery Monitor for accurate monitoring and control of the battery pack's state of charge. This monitor also logs historical data on the batteries usage and provides the trigger switch for a low SOC% or Low Overall voltage. The monitor is pre-programmed with all of the alarm set points to match the specific installation. The meter will show all of the relative information like Volts, Amps, Amp-hours, Percentage State of Charge & Time to go. It will also record all of the history data of the Lithium battery, Deepest Discharge, Battery Cycles, Hi/Low Voltage & Amps, All Alarm History Etc. This is a critical part of the Lithium battery installation kit.
- A Blue Sea 500amp main battery latching relay which is activated by the ePRO Battery Monitor when the low state of charge (percentage is reached).
- A Class T Fuse for system protection.
- 95mm^2 Battery cable from the battery to the Connection Kit.

1. Charge battery indicator
2. Numeric value indicator field
3. Setup lock / Master lock indicator
4. Main battery or Auxiliary battery indicator
5. State-of-charge bar
6. Charging in progress indicator
7. Alarm activated indicator
8. Readout units
9. Synchronize indicator
10. Next value or Right key (>)
11. Menu key
12. Previous value or Left key (<)

VOLTAGE

% REMAINING

AMPERE HOURS

AMPS

TIME REMAINING

The ePRO Battery Monitor has been pre-programmed at the factory to suit the selected Lithium system and is software locked. There is no setup interaction required by the end user. For more user information on the ePRO Battery Monitor, please refer to the detailed instruction manual included in your Caravan documentation package.

Voltages for Lithium batteries have a very narrow window compared to lead acid batteries. With all of our testing over the last 2-3 years, the Enerdrive Lithium battery standing voltage when fully charged (with no loads running) will be between 13.35v-13.45v at 100% capacity.

When discharged to near 25% capacity remaining, the standing voltage will be between 12.90v-13.00v

As you can see here, the voltage variance between 100% full and 25% full is only 0.55v. This is quite different to lead acid batteries where voltage can range from 12.72v at 100% to 11.88v at 20% capacity.

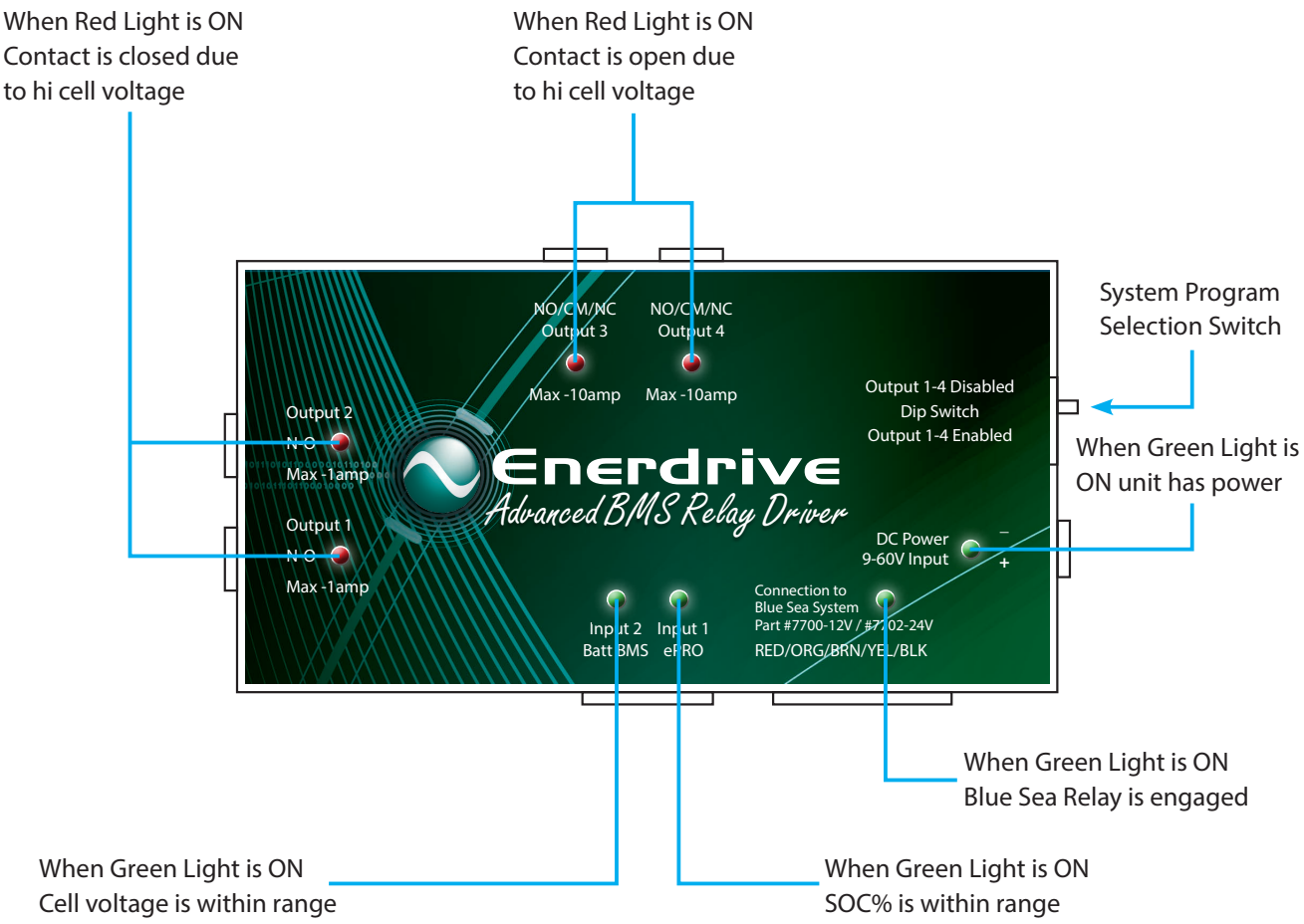
With Lithium, it is better and more accurate to work on the State of Charge Percentage (SOC%) to determine your remaining battery capacity.

So what's so advanced about the Advance BMS Relay Driver?

2 x Normally Open Contacts (1 amp Max) each - used to operate Relays connected to Chargers, Solar or a DC/AC relay connected to Combi Units (HV protection)

1 x Normally Open/Closed Contact (10 amp Max) - used to operate a relay connected to Chargers, Solar or a DC/AC relay connected to Combi Units. (HV protection)

1 x Normally Open/Closed Contact (10 amp Max) - used to operate Field wire of Alternator, Requirements of Alternator must be assessed to see if this is suitable as will not suit all applications



Troubleshooting the Lithium Battery System

Q: If the battery monitor reads 24% or less or the battery voltage has reached 12.4v or less, and the power has gone out in the van?

A: The battery has reached its maximum discharge and the main battery relay has dis-engaged to protect the battery. Turn off all loads and turn on the charging sources. Once the percentage on the ePRO Meter reaches 28%, you can push the yellow button on the main battery relay to re-engage the main battery switch and start turning on your loads. Keep charging sources connected until the battery reaches maximum charge 100%

Q: What if I see red lights on, on the "outputs" of the Advance Relay Driver Box

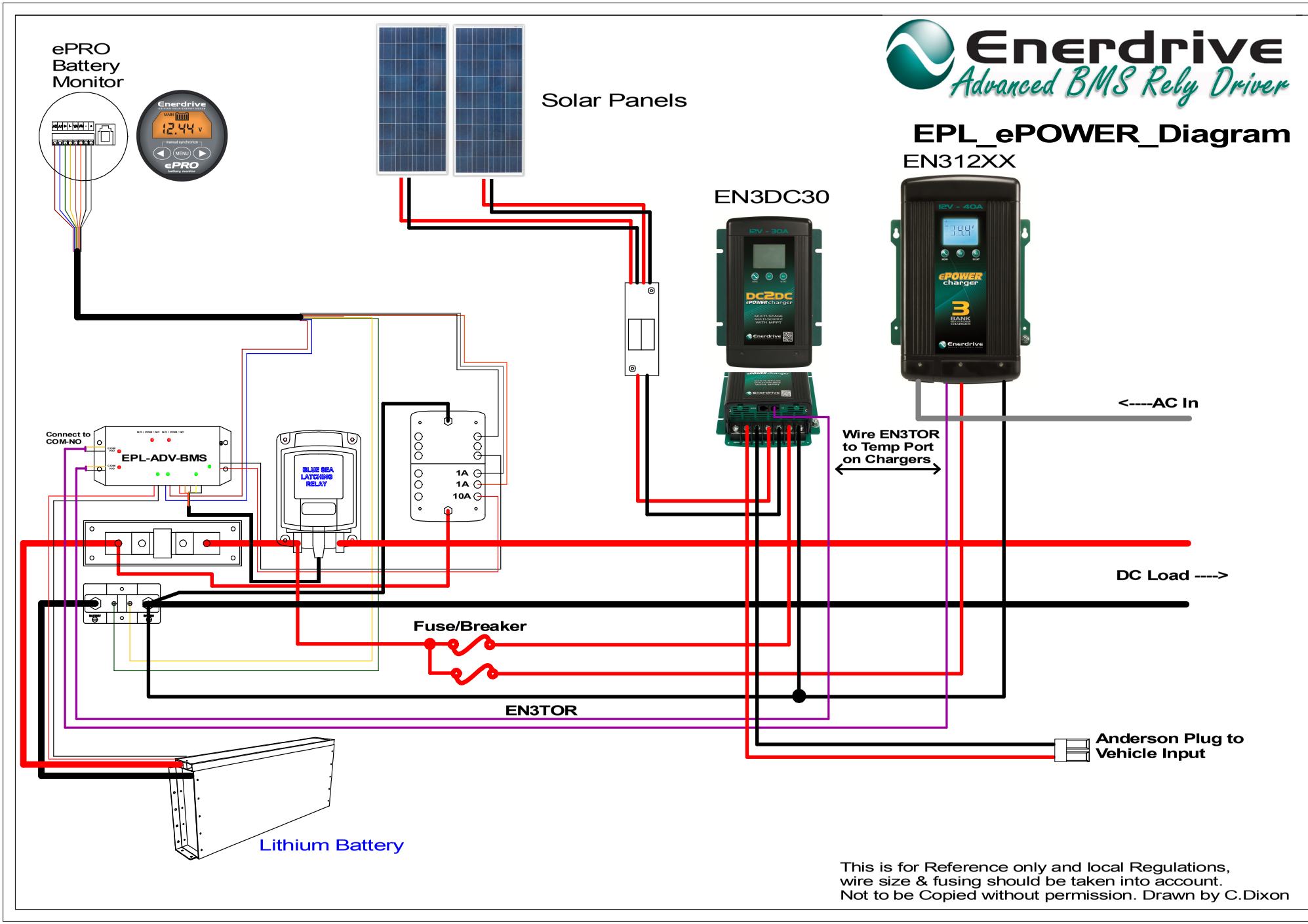
A: If a battery cell goes Hi Voltage and cuts the HI Voltage loop wire then the Advanced BMS Relay Driver will activate the output contacts (turning red) and will drive the installed relay/contacts to cut out all charging sources (solar/vehicle/main charger) for 10min. If the cell has not come back within range before 10min, it will stay active for another 10min and repeat until the cell/s are within range.

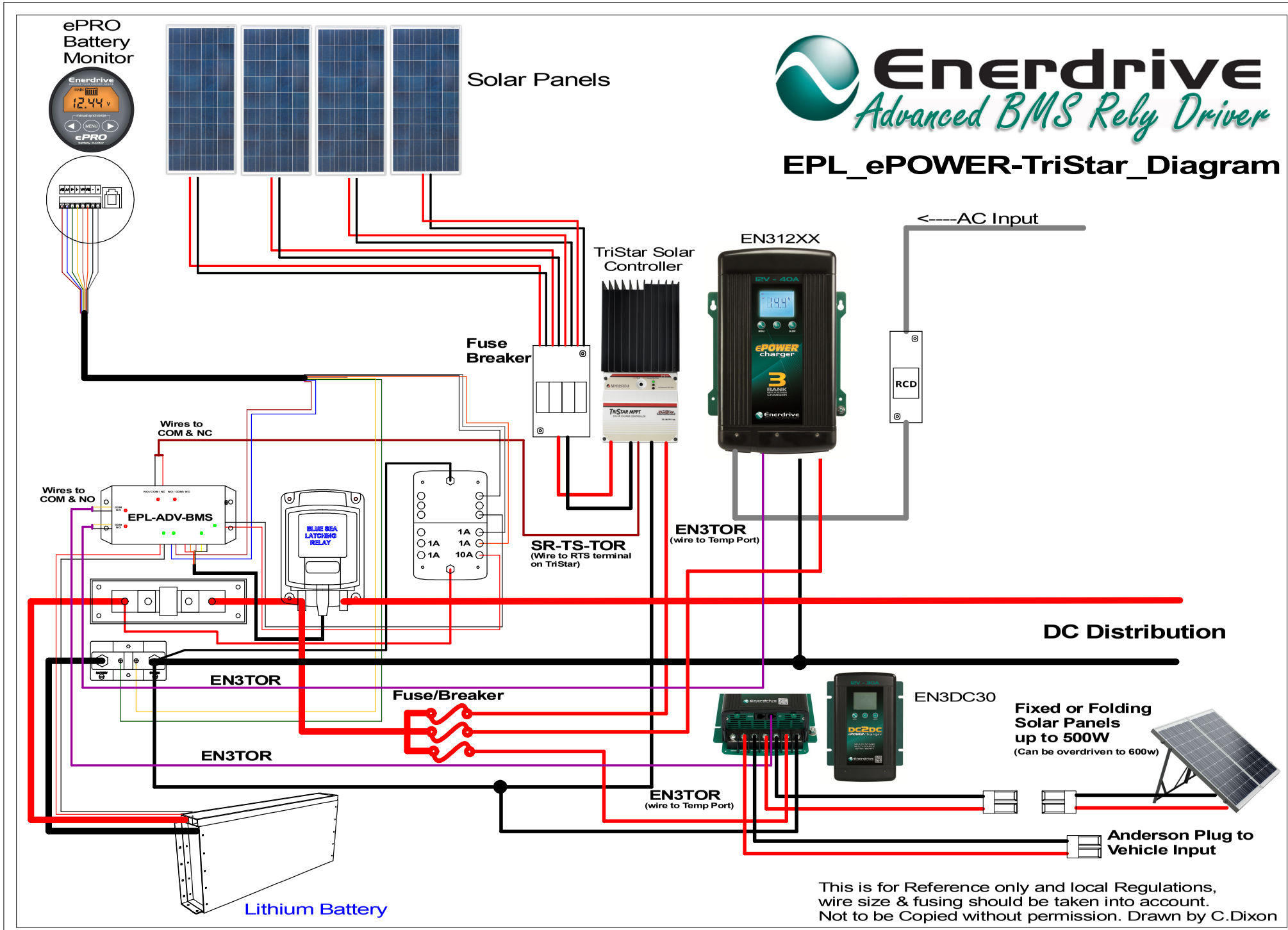
Q: What if the main battery switch has tripped out, but all the lights on the Advanced BMS Relay Driver box are green and the battery monitor is 26% or higher in capacity?

A: This has happened because the ePRO monitor has registered a "hi voltage" (15.2v or higher) and has tripped out the main battery switch. Push the yellow button on the main battery relay to re-engage the main battery switch. If the battery switch continues to disengage, contact the manufacture for assistance.

Q: What if I see "no lights" on the Advance Relay Driver Box

A: If this happens, please check the in line 1amp fuse connected to the "DC Power" input on the Advance Relay Driver Box. If this fuse is intact, contact the manufacture for assistance.


ePRO
Battery
Monitor
Solar Panels
Enerdrive
Advanced BMS Rely Driver
EPL_ePOWER_Diagram
EN312XX
EN3DC30
<----AC In
Wire EN3TOR
to Temp Port
on Chargers
Connect to
COM-NO
EPL-ADV-BMS
BLUE SEA
LATCHING
RELAY
1A
1A
10A
DC Load ---->
Fuse/Breaker
EN3TOR
Anderson Plug to
Vehicle Input
Lithium Battery
This is for Reference only and local Regulations,
wire size & fusing should be taken into account.
Not to be Copied without permission. Drawn by C.Dixon


ePRO
Battery
Monitor
Solar Panels
Enerdrive
Advanced BMS Rely Driver
EPL_ePOWER-TriStar_Diagram
<----AC Input
EN312XX
TriStar Solar
Controller
Fuse
Breaker
RCD
Wires to
COM & NC
Wires to
COM & NO
EPL-ADV-BMS
BLUE SEA
LATCHING
RELAY
1A
1A
1A
10A
SR-TS-TOR
(Wire to RTS terminal
on TriStar)
EN3TOR
(wire to Temp Port)
DC Distribution
EN3TOR
Fuse/Breaker
EN3DC30
Fixed or Folding
Solar Panels
up to 500W
(Can be overdriven to 600w)
EN3TOR
EN3TOR
(wire to Temp Port)
Anderson Plug to
Vehicle Input
Lithium Battery
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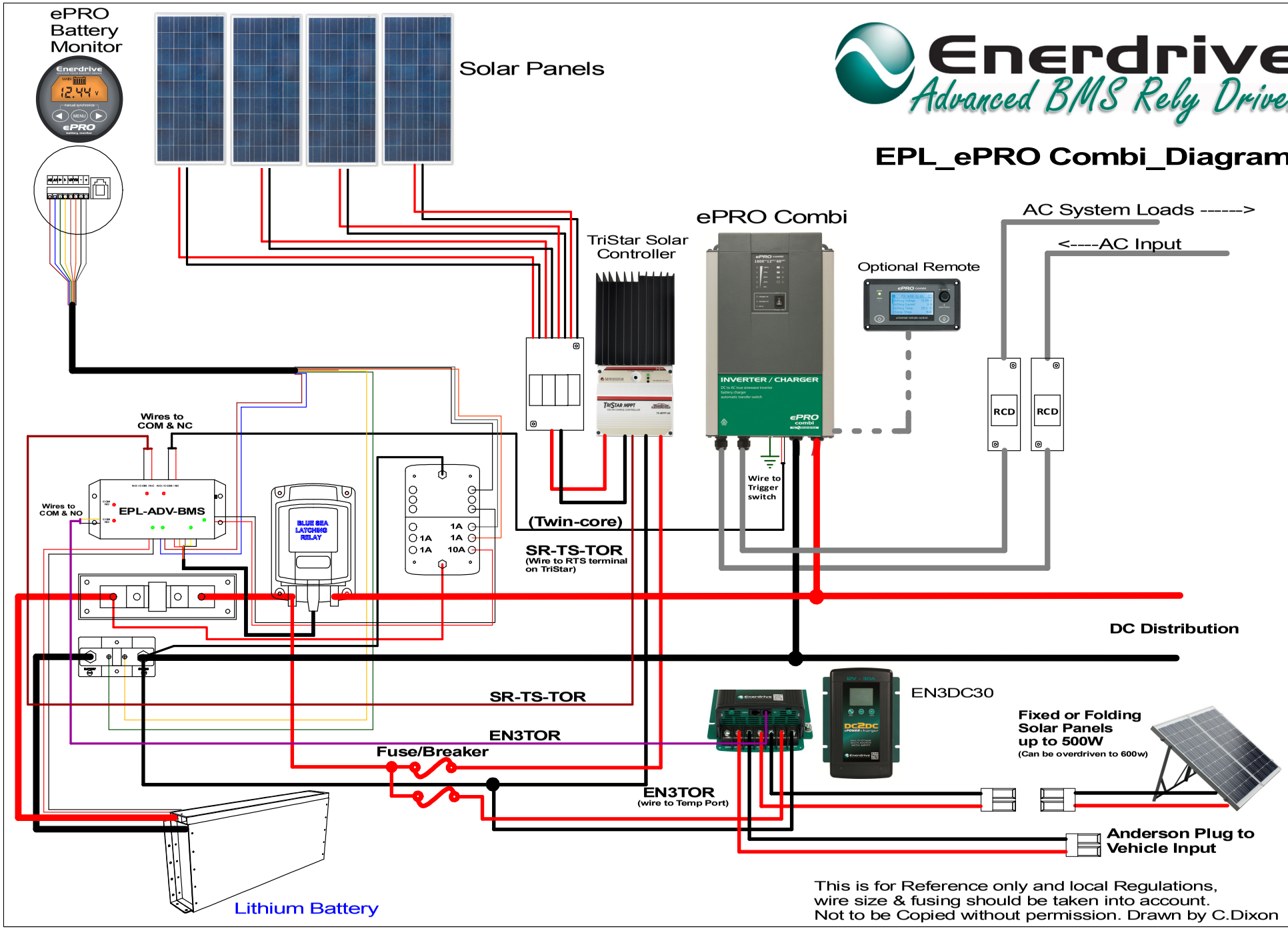
ePRO Battery Monitor
Solar Panels
Enerdrive
Advanced BMS Rely Driver
EPL_ePRO Combi_Diagram
ePRO Combi
TriStar Solar Controller
Optional Remote
AC System Loads ------>
<----AC Input
INVERTER / CHARGER
RCD
RCD
Wires to COM & NC
Wires to COM & NO
EPL-ADV-BMS
BLUE SEA LATCHING RELAY
1A
1A
1A
1A
10A
(Twin-core)
SR-TS-TOR
(Wire to RTS terminal on TriStar)
Wire to Trigger switch
DC Distribution
SR-TS-TOR
EN3TOR
Fuse/Breaker
EN3DC30
Fixed or Folding Solar Panels up to 500W
(Can be overdriven to 600w)
EN3TOR
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Anderson Plug to Vehicle Input
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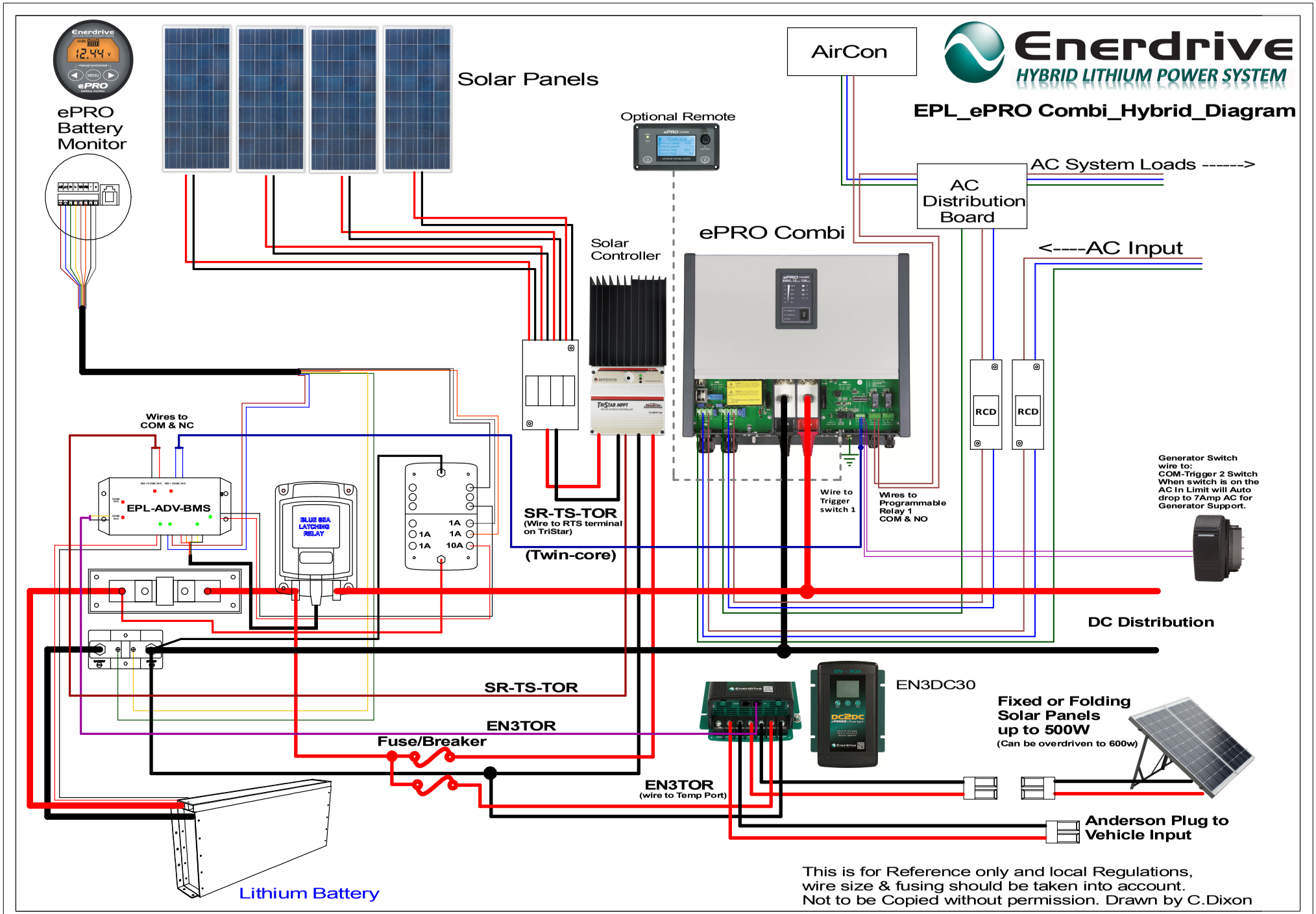
Enerdrive
HYBRID LITHIUM POWER SYSTEM
EPL_ePRO Combi_Hybrid_Diagram
ePRO Battery Monitor
Solar Panels
Optional Remote
AirCon
AC Distribution Board
AC System Loads ------>
<-----AC Input
ePRO Combi
Solar Controller
Wires to COM & NC
EPL-ADV-BMS
BLUE SEA LATCHING RELAY
1A
1A
1A
10A
SR-TS-TOR
(Wire to RTS terminal on TriStar)
(Twin-core)
Wire to Trigger switch 1
Wires to Programmable Relay 1 COM & NO
RCD
RCD
Generator Switch wire to: COM-Trigger 2 Switch When switch is on the AC In Limit will Auto drop to 7Amp AC for Generator Support.
DC Distribution
SR-TS-TOR
EN3TOR
Fuse/Breaker
EN3DC30
Fixed or Folding Solar Panels up to 500W
(Can be overdriven to 600w)
EN3TOR
(wire to Temp Port)
Anderson Plug to Vehicle Input
Lithium Battery
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Lithium Battery Warranty: Two Year Limited Warranty

Our goods come with guarantees that cannot be excluded under the Australian Consumer Law. You are entitled to a replacement or refund for a major failure and for compensation for any other reasonably foreseeable loss or damage. You are also entitled to have the goods repaired or replaced if the goods fail to be of acceptable quality and the failure does not amount to a major failure.

The limited warranty program is the only one that applies to this unit, and it sets forth all the responsibilities of Enerdrive. There is no other warranty, other than those described herein. Any implied warranty of merchantability of fitness for a particular purpose on this unit is limited in duration to the duration of this warranty.

Enerdrive Pty Ltd warrants its Lithium batteries (hereafter referred to as "Battery") to be free of defects in material and workmanship for the following Applicable Warranty Period:

- 2 years for commercial, industrial, marine and automotive applications in cycling and non-cycling applications. The battery is warranted, to the original purchaser only, to be free of defects in materials and workmanship for two years from the date of purchase without additional charge. The warranty does not extend to subsequent purchasers or users other than OEM applications.
- An additional 24 months Pro-Rata warranty is included in the battery. The pro-rated price is calculated as a percentage of the current suggested retail price. Pro-Rata warranty applicable to original end user only.

Enerdrive does not warrant the battery for use in any residential system sold with the intent or purpose of a "Tariff Adjustment Program" of any type.

The Enerdrive ePRO battery monitor that is standard with every Lithium-Ion battery kit is pre-programmed by Enerdrive to suit the battery configuration. Any changes that are made to the pre-configuration programming of the ePRO meter will void all warranty of the battery & system.

The warranty does not cover a battery reaching its normal end of life which may occur prior to the warranty period stated above. Depending on the application a battery can reach its normal end of life before the end of the warranty period.

A battery can deliver only a fixed number of usable cycles / amp-hours over its lifetime and is considered to have reached its normal end of life if the application uses up all of these cycles / amp-hours, regardless of the time the battery has been in service. Therefore Enerdrive reserves the right to deny a warranty claim if it determines the battery to be at its normal end of life, even if the claim is lodged within the applicable warranty period.

The Applicable Warranty Period begins from the date of purchase with original receipt, or, if no receipt is available, from Enerdrives invoice / shipping date.

Batteries determined to meet the conditions of this warranty will be replaced free of charge if, at the sole discretion of Enerdrive, adjustment is necessary due to defect in material or workmanship. Batteries for warranty replacement consideration are to be returned to the original supplying distributor/dealer.

Batteries replaced under the warranty provisions will be shipped with a replacement warranty sticker and carry only the remainder of the original Applicable Warranty Period.

The battery is not designed or warranted in the following areas:

- The Battery is NOT to be used in any Aviation aircraft application.
- The Battery is NOT to be used in any lifesaving applications
- The Battery is NOT to be exported to USA/Canada and their territories
- Any residential system sold with the intent or purpose of a "Tariff Adjustment Program" of any type.

PLEASE NOTE

The battery has a self-discharge rate of 5% per month @ 25°C. When storing the battery with the main latching relay disengaged, the ePRO Battery Monitor and Advance Relay Driver will still be powered adding a further drain on the battery.

It is the responsibility of the end user to maintain the battery in a charged state. The battery should not be left for more than 30 days without checking its charge state. Enerdrive recommend that a battery left in a "storage state" should be checked and charged every 30 days to maintain maximum life expectancy of the battery. Failure to follow these requirements will see an early failure of the battery which is not covered under warranty.

General Provisions:

Enerdrives Pty Ltd has no obligation under the limited warranty herein in the event the battery is damaged or destroyed as a result of one or more of the following:

- Wilful abuse, misuse, physical damage, neglect or if the decorative cover has been removed.
- Natural forces such as wind, lightning, hail; damage due to fire, collision, explosion, vandalism, theft, penetration or opening of the battery case in any manner.
- The supplied Enerdrive ePRO battery monitor is pre-programmed by Enerdrive if and any changes are made to the pre-configuration programming of the meter, all warranty is void.
- The battery MUST be installed in an upright position. Installing it upside down or laid on its side will void warranty.
- Overcharging, undercharging, charging or installing in reverse polarity, improper maintenance, allowing the battery to be deeply discharged via a parasitic load or mishandling of the battery such as but not limited to using the terminals for lifting or carrying the battery.
- Charging sources that do not have programmable lithium profile configurations and charge voltage between 13.5V and 14.5V (no lower than 13.0V and no higher than 14.7V) will cause early failure of the battery. Use of such chargers with the battery will also void the battery's warranty. For applications where an alternator is present, the alternator must deliver between 13.5V and 14.2V when measured at the Battery's terminals. Alternators that do not have a regulated charge between 13.5V and 14.2V (no lower than 13.0V and no higher than 14.7V) will cause early failure of the battery. Use of such alternators with the battery will also void the batteries warranty.
- All Enerdrive batteries are supplied with an additional battery installation kit. Failure to install or properly install the battery and its installation kit will void the warranty
- Repair or attempted repair of the battery by anyone other than an authorized Enerdrive representative shall void this warranty.
- Normal or accelerated deterioration in the electrical qualities due to operating or application conditions.
- If the battery is used for an application that requires higher cranking power or a greater reserve rating than the battery is designed to deliver, or the battery capacity is less than the battery capacity specified by the manufacturer, or the battery is otherwise used in applications for which it was not designed.
- Prolonged storage of the battery with either no charge or a parasitic consumption load applied must be offset with a maintenance-float charger of no more than 13.5V or periodic charging or disconnecting the battery to prevent irreversible damage to the battery.
- A battery with an open circuit voltage (OCV) of equal to or less than 10.0V will be deemed as over discharged and void warranty due to misuse and/or neglect.

- **WARNING** - Do NOT use any type of oil, organic solvent, alcohol, detergent, strong acids, strong alkalis, petroleum-based solvent or ammonia solution to clean the battery covers and end plates. These materials may cause permanent damage to the battery covers and end plates and will void the warranty.

Return and/or Repair Policy

If you are experiencing any problems with your unit, please contact our customer service department at support@enerdrive.com.au or Phone 1300 851 535 before returning product to retail store. After speaking to a customer service representative, if products are deemed nonworking or malfunctioning, the product may be returned to the purchasing store within 30 days of original purchase. Any defective unit that is returned to Enerdrive within 30 days of the date of purchase will be replaced free of charge.

If such a unit is returned more than 30 days but less than two years from the purchase date, Enerdrive will repair the unit or, at its option, replace it, free of charge. If the unit is repaired, new or reconditioned replacement parts may be used, at manufacturer's option. A unit may be replaced with a new or reconditioned unit of the same or comparable design. The repaired or replaced unit will then be warranted under these terms for the remainder of the warranty period. The customer is responsible for the shipping charges on all returned items back to Enerdrive.

Limitations

This warranty does not cover damage or defects resulting from normal wear and tear (including chips, scratches, abrasions, discolouration or fading due to usage or exposure to sunlight), accidents, damage during shipping to our service facility, alterations, unauthorized use or repair, neglect, misuse, abuse, failure to follow instructions for care and maintenance, acts of god, fire and flood.

If your problem is not covered by this warranty, contact our Support Team at support@enerdrive.com.au or phone 1300 851 535 for general information if applicable.

Enerdrive
DRIVING YOUR ENERGY NEEDS

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Email: support@enerdrive.com.au
Web: www.enerdrive.com.au

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